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ABSTRACT

This study of the effects of practice on children's perceptual judgments investigates the validity of the distinctive features hypothesis and the schemata hypothesis by comparing performance on discrimination tasks using familiar stimuli (letters of the alphabet) with a variety of transformations held constant over four massed practice conditions. Subjects (15 males and 15 females 3.10 to 4.11 years old) were presented with a visual form discrimination task which required them to match Roman letters when a variety of transformations were held constant. Subjects were given massed practice across four blocks of eight stimuli each. Results of a repeated measures analysis of variance showed support for the distinctive features hypothesis. This result was expected, since familiar stimuli used with transformations which are held constant tend to produce no improvement along a practice dimension. (Author/SB)

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A Test of the Distinctive Features and Schemata Hypotheses: Implications to the Teaching of Concepts to Young Children

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Practice on Form Discrimination

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Abstract

Thirty subjects (15 males and 15 females) were presented with a visual form discrimination task which required subjects to match Roman letters when a variety of transformations were held constant. Subjects were given massed practice across four blocks of eight stimuli each. The purpose was to compare the effects of practice under both the distinctive features and the schemata hypotheses. Results of a repeated measures analysis of variance showed support for the distinctive features hypothesis. This result was expected since familiar stimuli used with transformations which are held constant tend to produce no improvement along a practice dimension.

A Test of the Distinctive Features and

Schemata Hypotheses:

Implications to the Teaching

of Concepts to Young Children

The issue as to whether children's perceptual judgments improve with practice has been discussed with respect to the distinctive features and schemata hypotheses. The first hypothesis states that distinctive features are dimensions of object and pattern differences. Improvement of discrimination among objects or patterns consists of learning the specific distinctive features. The function of practice, then, enables one to respond to an increasing number of features and to discover which features are "critical" for defining the objects or patterns.

The second hypothesis suggests that prototypes or models of objects or patterns have been built up through repeated experiences and "stored" in memory. Improvement in discrimination would first involve building a new schemata or model for making discriminations and then matching sensory stimuli to the existing schemata. The function of practice allows for the construction and refinement of appropriate schemata (Pick, 1976). Thus, the operation starts with an individual recording data, such as various sizes and arrangements of the letter "A", and organizing them in a schemata. This schemata is then used to direct subsequent perceptual activities involving the letter "A".

Pick (1965), used three groups of kindergarten children to compare the effects of practice under both the distinctive features and the schemata hypotheses. In the first group, a control condition, the children were trained on one set of stimuli and transformations and tested on a transfer

task which used another set of stimuli and transformations. In the second group, schemata condition, the transfer task consisted of the same stimuli but different transformations; while in the third group, distinctive features condition, the transfer task consisted of new stimuli but the same transformations. This latter group had the fewest errors. Thus, Pick concluded that learning distinctive features of form may be a significant component for improvement in the discrimination ability of young children.

The distinctive features and schemata hypotheses may not, however, be mutually exclusive. A basic tenet of these hypotheses is that the ability to discriminate the unfamiliar improves with practice, both with or without knowledge of results. Thus, the formation and subsequent refinement of a schema may require that the individual notice particular distinctive features in a stimulus so that he is able to change the initial schemata being used to guide new encoding.

In a situation where the stimuli are already familiar to the subjects and the transformations are the same, one would expect, according to the distinctive features hypothesis, that no improvement would occur with repetition; however, according to the schemata hypothesis, one would expect repetition to improve discriminations as one practices transformations using familiar stimuli. It is the specific purpose of this study to investigate the validity of these two hypotheses using familiar stimuli, letters of the alphabet, with a variety of transformations held constant over four massed practice conditions.

Method

Subjects. Subjects were 15 males and 15 females ranging in age from 3.10 years to 4.11 years who were randomly selected from three preschools

in the Menlo Park, California area. The mean age was 4.3 years.

Materials. The materials consisted of a portable box and 32 stimuli cards. The portable box had five plexiglass windows. These windows faced the subject. One subject response button was located beneath each of windows 2, 3, 4, and 5. Window 1 was on the far left and always displayed the target on the stimulus card. This target form was to be matched as "same" with one of the four other forms presented simultaneously in the other windows. The serial positioning of the windows encouraged subjects to search the stimuli from left to right.

During each subject's trials, the experimenter held a small console unit with four red indicator lights. When the subject pushed a correct response button, a red light flashed on the experimenter's console unit. This arrangement allowed the experimenter to sit to the side and behind the subject making it possible to keep the subject's attention directed towards the task while still being able to accurately determine his response.

Each of the 32 stimuli cards was a 20 inch X 6 inch (50.80 cm. X 15.24 cm.) masonite board bearing five 4 inch X 4.5 inch (10.16 cm. X 11.43 cm.) black and white, high gloss, photographed stimulus forms. Each of the five forms appeared through the appropriate window of the portable box. The forms consisted of lower-case Roman letters (a b c e f g h i j k m n o q r s t u v w y z) and were chosen from a confusion matrix (Gibson, Osser, Shiff, & Smith, 1963).

The letters were rotated and arranged into 16 simple and 16 complex stimuli cards. A simple card presented the same letter in each window. This letter was rotated in either four different horizontal-vertical positions or four different oblique positions. A complex card presented two letters in each window. These letters were also rotated in either four differen

horizontal-vertical positions or four different oblique positions.

The 32 cards were randomized into four blocks of eight stimuli each. The four response choices on each stimulus card were also randomized so that each of the four non-target windows presented the correct stimulus match an equal number of times.

Procedure. Each subject received an individual reading of the instructions and was given a demonstration trial before beginning the matching task. The instructions were as follows:

> "You sit here and I'll sit next to you and show you how to play a game (put card in box). Look at all these letters (point). Now look at this letter (point). Press the red button with your finger when you have chosen the letter that looks the same as this one (take card out). Now I'm going to show you some more letters. Look at each letter and press a red button under the letter that looks just like the letter in this window (point)."

If the subject responded correctly on the demonstration trial, the experimenter proceeded to give the 32 trials, saying each time "which letter looks just like this one." If the subject did not respond correctly to the demonstration trial, the instructions were repeated. All subjects responded correctly on either the first or second demonstration trial.

The dependent variable was the number of error responses. To test the distinctive features and schemata hypotheses, a repeated measures design with four levels of starting block position and 30 subjects was used.

Results

The means and standard deviations for the four block positions are presented in Table 1. The higher the score the more ineffective was the subjects' performance on the task. An examination of this table shows that block four had the highest mean score.

Insert Table 1. here

Table 2 presents a summary of the repeated measures analysis. The results indicated that block position (practice) had no effect on performance, $F(1,87) = 1.42$, $p > .05$. Since there were no practice effects, these results support the distinctive features hypothesis as opposed to the schemata hypothesis.

Insert Table 2. here

A further examination of all possible pairs of means was made. Using a Neuman-Keuls method as described in Winer (1962, pp. 309-310), it was found that there were no significant differences, $p > .05$. This lends additional support to the distinctive features hypothesis.

Discussion

Table 1 indicates that errors increase with practice. The child with knowledge of the distinctive features of familiar alphabetical letters made fewer errors in the first practice block than in the fourth practice block. Repetition did not facilitate learning the unfamiliar, same type transformation. Thus, the results failed to support the schemata hypothesis, and instead, supported the distinctive features hypothesis.

One reason why this study might not have supported the schemata hypothesis is that the stimuli were too confusing. Piaget and Inhelder (1969) have indicated that four-year-old children do not perform well in tasks requiring them to deal with more than one dimension along a stimulus variable. This suggests that tasks which include more than one stimulus

variable may be too confusing to the young child.

For example, in this study, the child was required to recognize letters and their transformations within simple and complex patterns. The large array of stimuli may have introduced more information than the child could use in terms of matching a prototype to a cognitive model. Practice, therefore, may have been ineffective since the children were unable to utilize information along several dimensions. However, since the children who participated in this study gave correct answers in approximately 64 percent of the instances, it would tend to indicate that the stimuli used were not too difficult. The argument suggesting that the stimuli were too confusing would, therefore, be an incomplete explanation as to why the schemata hypothesis was not supported.

Consideration of the novelty of the stimuli used might serve as an alternative reason for the lack of support shown for the schemata hypothesis. Gibson (1969) noted that practice does not facilitate form perception if the stimuli are not novel. Herein lay a difficulty in proving the schemata hypothesis. Lower case Roman letters are generally familiar forms within the visual experience of most four-year-old children. The unusual aspect of the stimuli was its various transformations. These transformations, however, may not have been perceived as unusual by the child who does not yet understand why a "d" functions differently from a "b". In this sense, transformations may have been ignored.

The results of this study clearly support the distinctive features hypothesis and may have implications for teaching concepts to young children. For instance, when introducing unfamiliar alphabetical letter and numerical concepts, it appears important to define for the child the distinctive features of the form. This enables the child to focus on the crucial aspects of the concept while also developing and refining his concept schema. Once

a letter or numerical concept is familiar, sharpening or broadening knowledge of it is not facilitated by practicing with the concept in different situations. If the above is valid, it would tend to indicate that the often used practice and drill techniques presented in learning perceptual material such as matching, locating embedded stimuli, identifying stimuli on flash cards, and repetitious writing of familiar concepts would tend to be unproductive.

References

Gibson, E. J. Principles of Perceptual Learning and Development. New York: Appleton-Century-Crofts, 1969.

Gibson, E. J., Osser, H., Schiff, W., & Smith, J. An analysis of critical features of letters, tested by a confusion matrix. In A Basic Research Program on Reading. Cooperative Research Project No. 639, U. S. Office of Education, 1963.

Piaget, J., & Inhelder, B. The Psychology of the Child. New York: Basic Books, 1969.

Pick, A.D. Improvement of visual and tactual form discrimination. Journal of Experimental Psychology, 1965, 69, 331-339.

Winer, B. J. Statistical Principles in Experimental Design, New York: McGraw-Hill, 1962.

Table 1

Means and Standard Deviations*

on Error Responses Across Four Practice Blocks

Practice Block Positions			
1	2	3	4
2.57	2.90	2.70	3.23
(1.35)	(1.79)	(1.62)	(1.25)

* Standard deviations are in parentheses

Table 2

Repeated Measures Analysis of Variance

with Four Levels of Practice Block Position

Source	SS	df	MS	F
Blocks	7.57	3	2.52	1.42[a]
Subjects	113.30	29	3.91	
Error	154.43	87	1.78	
Total	275.30	119		

[a] = not significant